The Profile Envision and Splice Tool (PRESTO): Developing an Atmospheric Wind Analysis Tool for Space Launch Vehicles Using Python

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Tropospheric winds are an important driver of the design and operation of space launch vehicles. Multiple types of weather balloons and Doppler Radar Wind Profiler (DRWP) systems exist at NASA's Kennedy Space Center (KSC), co-located on the United States Air Force's (USAF) Eastern Range (ER) at the Cape Canaveral Air Force Station (CCAFS), that are capable of measuring atmospheric winds. Meteorological data gathered by these instruments are being used in the design of NASA's Space Launch System (SLS) and other space launch vehicles, and will be used during the day-of-launch (DOL) of SLS to aid in loads and trajectory analyses. For the purpose of SLS day-of-launch needs, the balloons have the altitude coverage needed, but take over an hour to reach the maximum altitude and can drift far from the vehicle's path. The DRWPs have the spatial and temporal resolutions needed, but do not provide complete altitude coverage. Therefore, the Natural Environments Branch (EV44) at Marshall Space Flight Center (MSFC) developed the Profile Envision and Splice Tool (PRESTO) to combine balloon profiles and profiles from multiple DRWPs, filter the spliced profile to a common wavelength, and allow the operator to generate output files as well as to visualize the inputs and the spliced profile for SLS DOL operations. PRESTO was developed in Python taking advantage of NumPy and SciPy for the splicing procedure, matplotlib for the visualization, and Tkinter for the execution of the graphical user interface (GUI). This paper describes in detail the Python coding implementation for the splicing, filtering, and visualization methodology used in PRESTO.